PBCRC2135: Optimising Plant Biosecurity Surveillance Protocols for Remote Sensing using Unmanned Aerial Systems

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Abstract:
Recent advancements in technologies of high-resolution, thermal, multispectral and hyperspectral sensors for remote sensing, along with the affordability and availability of small unmanned aerial systems (UAS) in the marketplace provide a unique opportunity to evaluate the use of these technologies for detecting invasive species across different scales, as illustrated in Figure 1. This project aims to provide end-users with the value of these technologies in guiding decisions and adopting systems based on capabilities to detect species on varying host plants and in diverse environments. Specific and measurable benefits will include reductions in sampling time or changes in efficiency, cost-savings, more effective use of resources, and potential reductions in harvest losses and control costs.

The aim of this project is to use predictive models combined with advanced detection systems to increase sampling efficiency and improve first detection rates.

The project objectives are as follows:

1. Modelling region-wide environmental changes to identify criteria for selecting high-risk surveillance areas and compare these predictors to current selection methods deployed by biosecurity personnel;
2. Prioritise sampling times and areas within targeted areas to direct surveillance efforts and increase rate of first detection using higher-resolution surveillance technologies and unique spectral signatures;

3. Evaluate utility of higher-resolution cameras and robotic technologies on multi-rotor UASs to categorise and/or collect target pests on different plant structures for identification by trained diagnosticians; and
4. Synthesise modelling and improved UAS technologies to demonstrate a practical application for surveillance of high priority plant pests in commercial crops.

The project has begun compiling a national database encompassing information on past incursions of stripe rust throughout grain growing regions of Australia. The database includes information on the location and timing of past incursions as well as environmental data including minimum and maximum temperatures associated with each stripe rust occurrence. This database will be used to help develop predictive models that are used to determine the best time and place to sample stripe rust in order to ensure accurate and early disease identification and to minimise the likelihood of yield reduction as a result of stripe rust infections. This will help identify potential surveillance areas for further investigation by UAS equipped with advanced remote sensing technologies, namely, high-resolution, thermal, multispectral, and hyperspectral sensors.

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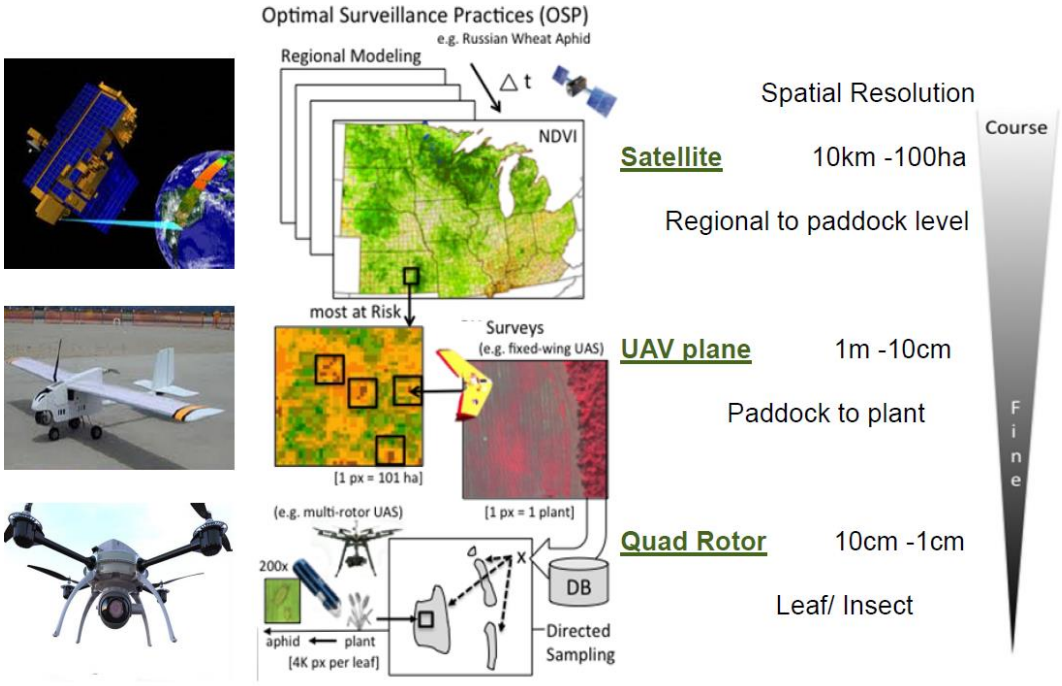

Figure 1. Illustration of PBCRC2135 Project.